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Comparisons of Aerosol Optical Depth provided by SEVIRI satellite observations and CAMx air quality modelling.

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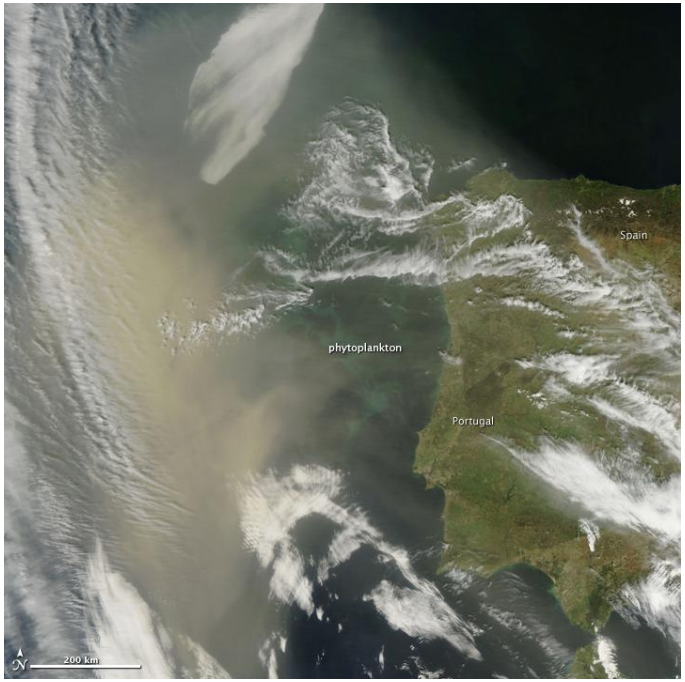
Motivation

The use of air pollution modelling in combination with satellite data opens the challenging perspective to analyse the contribution of different pollution sources and transport processes.

- Help to a better understanding of particulate matter levels in the atmosphere, as a still concerning pollutant

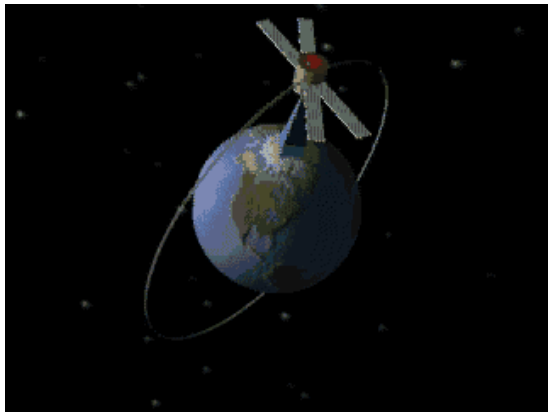
- Satellite data provide higher resolution spatial and temporal variability

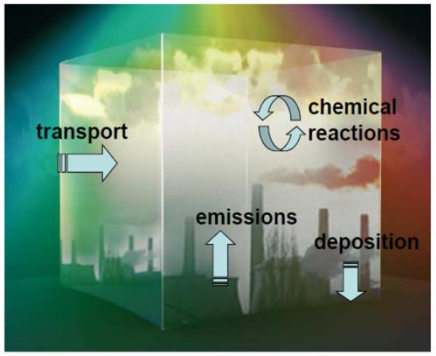


Objective

Study the **AOD over Portugal** using **satellite observations** in combination with **air pollution modelling**.

Spinning Enhanced Visible and Infra-Red Imager (SEVIRI) on-board the geostationary Meteosat-9 satellite



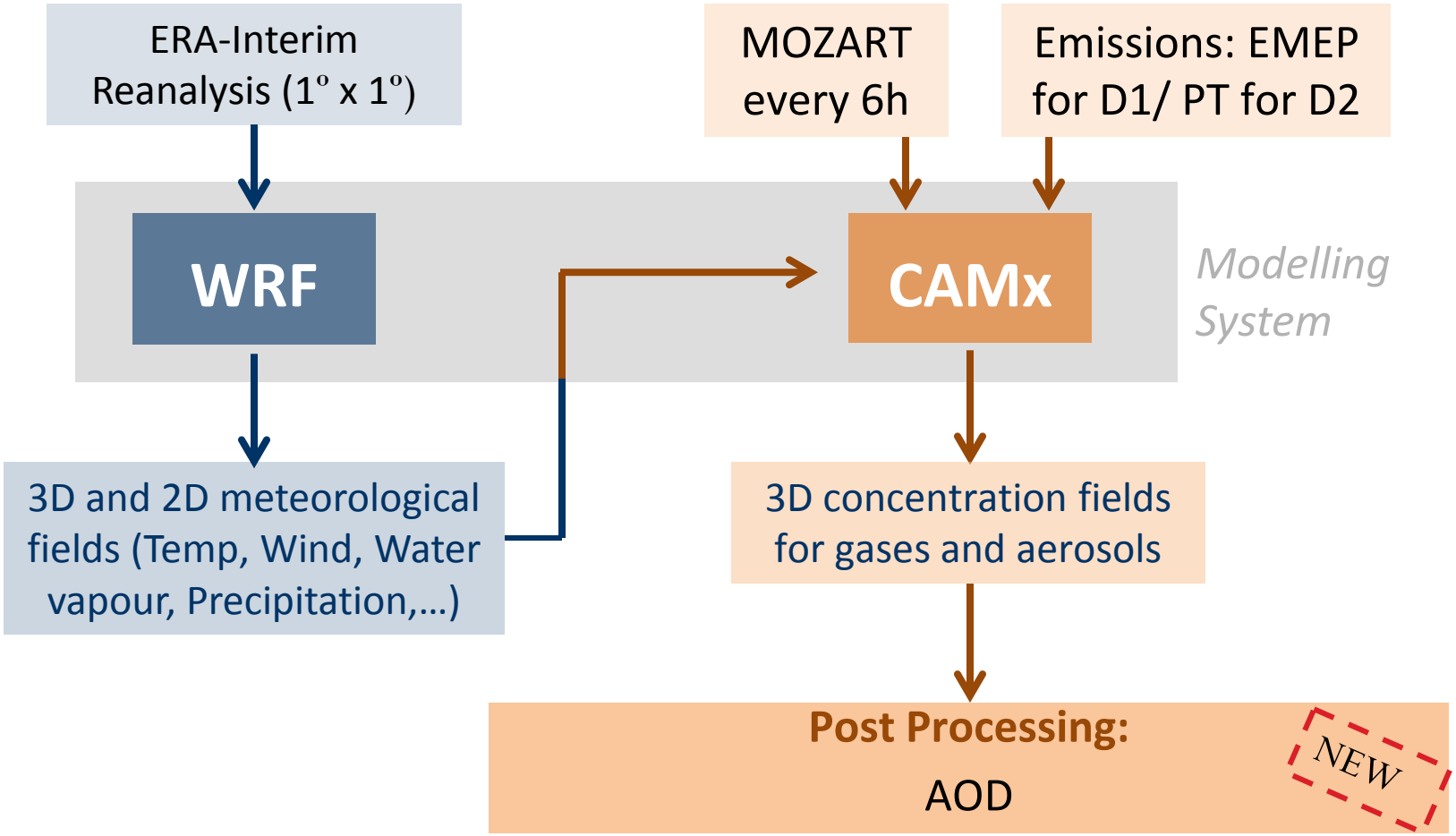


Chemical Transport Model (CAMx - Comprehensive Air quality Model)

Methodology

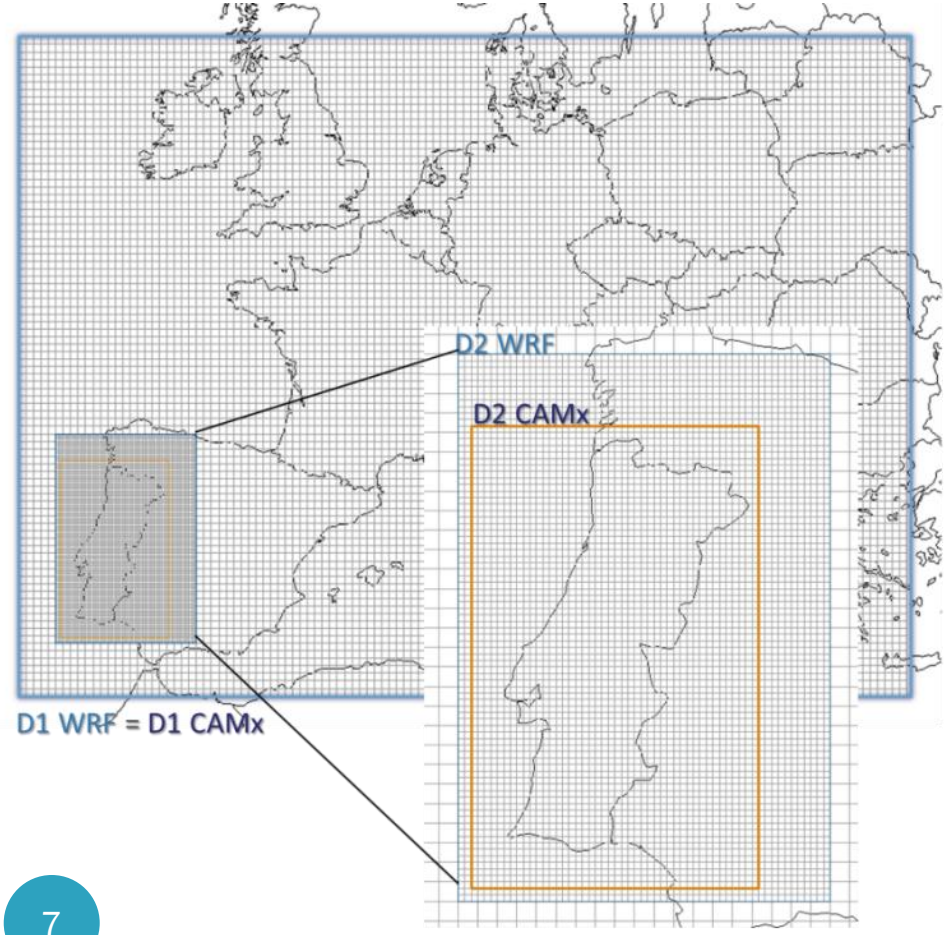
Methodology

Air Quality Modeling System



Methodology

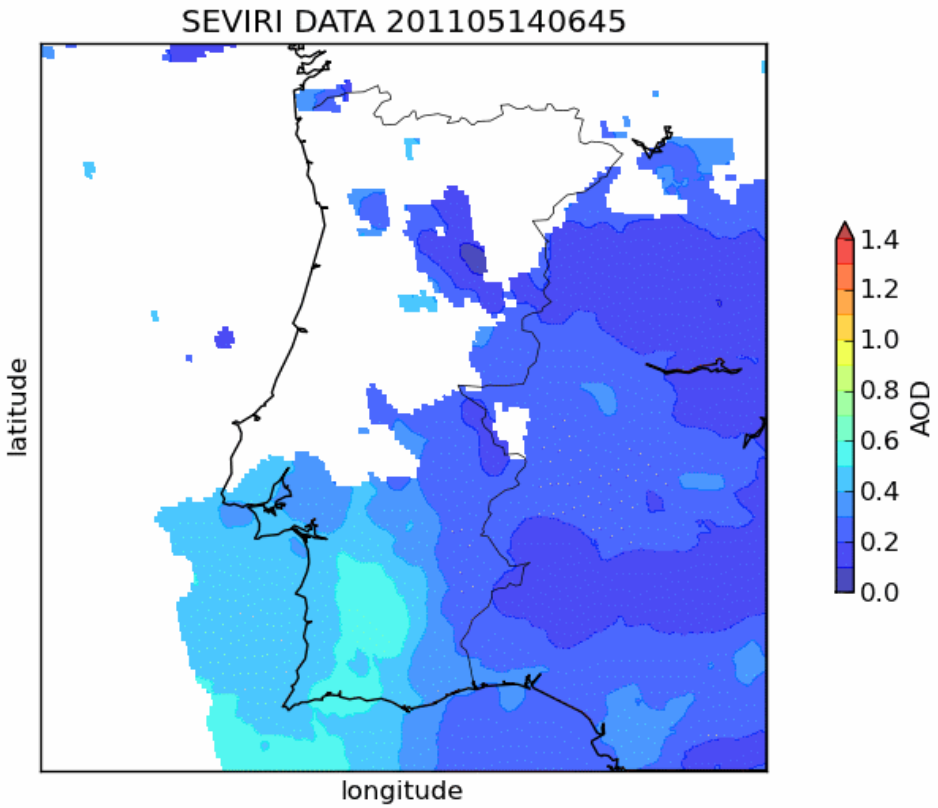
Air Quality Modeling



- ✓ Modelling domains for WRF and CAMx
  - D1 resolution 27 x 27 km^2
  - D2 resolution 9 x 9 km^2
- ✓ 20 km vertical column with 15 levels
- ✓ Dust - 4 Bins
  - Dust 1 – 0.1µm-1.0µm
  - Dust 2 – 1.0µm-2.5µm
  - Dust 3 – 2.5µm-5.0µm
  - Dust 4 – 5.0µm-10.0µm
- ✓ OC, BC, Sulfate
- ✓ May 2011
- ✓ Hourly data → To compare with satellite data were used data between **6h – 17h**

Methodology

Satellite Observations

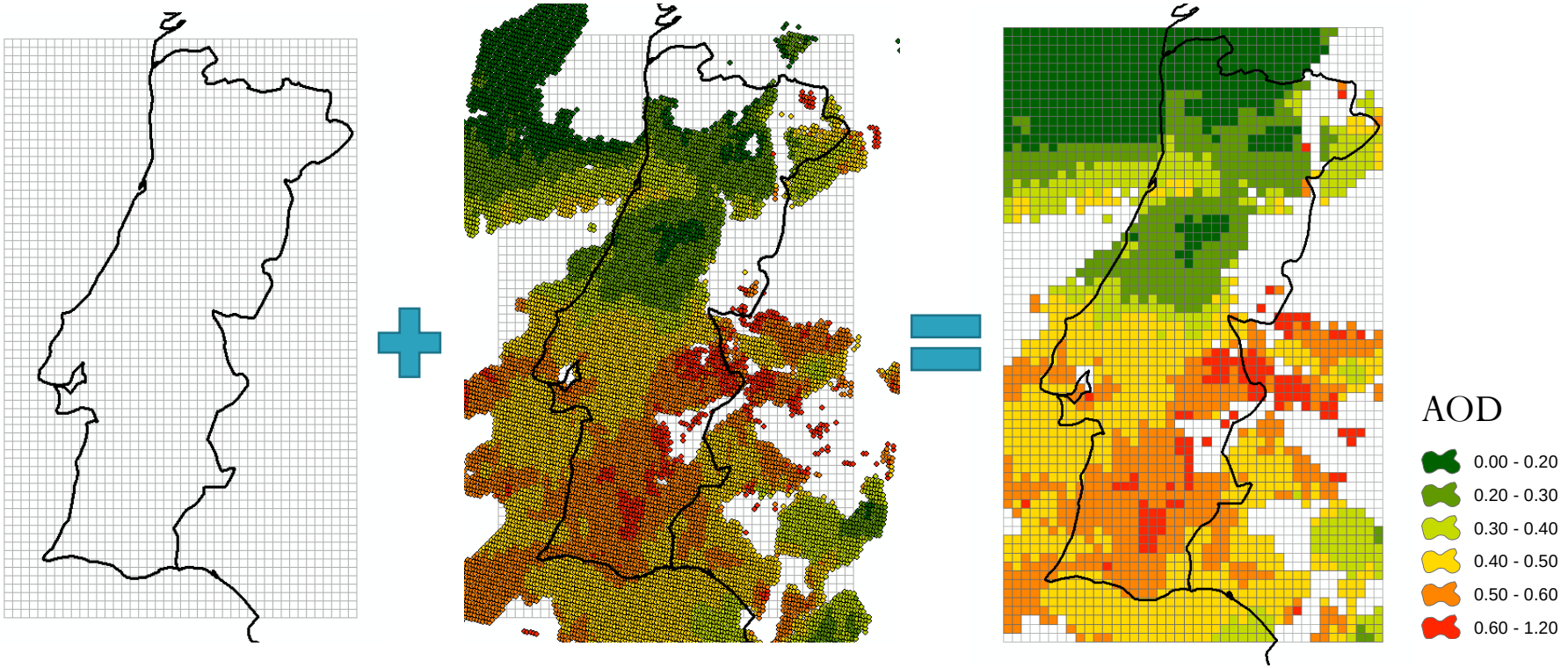


- ✓ Geostationary Satellite
- ✓ AOD at 550 nm
- ✓ Spatial resolution of 3 km
- ✓ Vertical column
- ✓ May 2011
- ✓ High temporal resolution of 15 minutes between 6h – 17h

Methodology

Satellite Observations

Example for 14/05/2011 at 14h



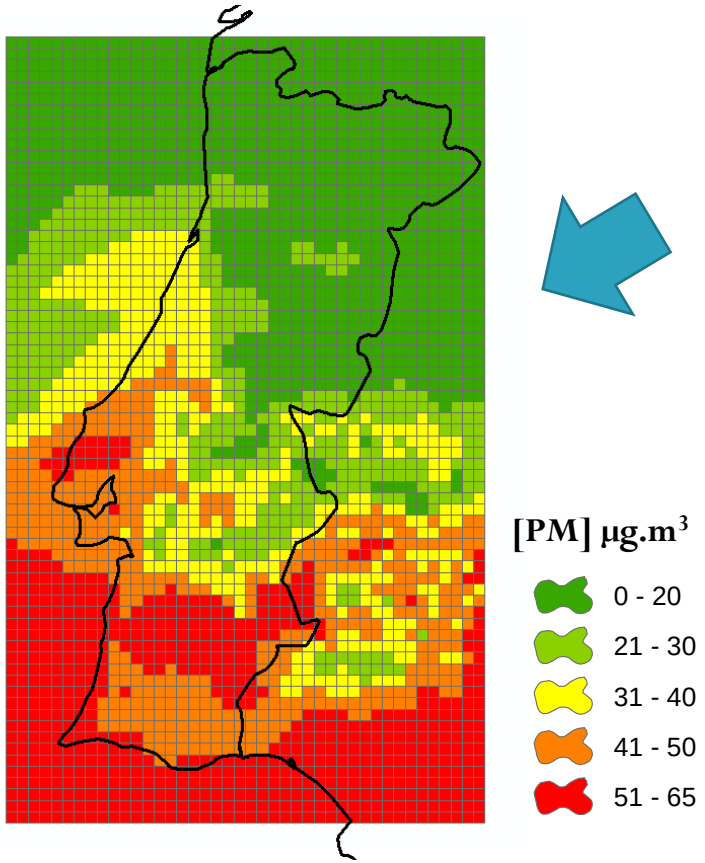
To compare the AOD retrieved from SEVIRI data with the modelling results it was necessary to select the **maximum value in each pixel** for each hour.

Results and discussion

Results and discussion

CAMx results - Spatial distribution of PM concentrations

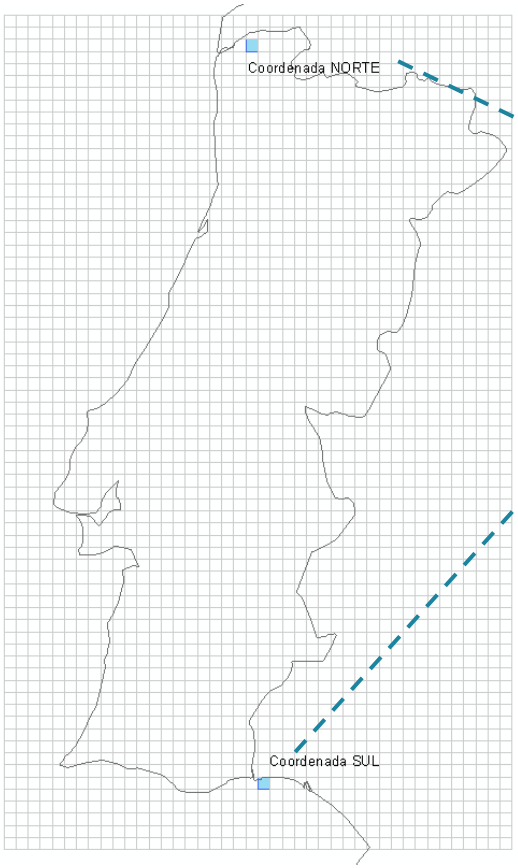
Example for 14/05/2011 at 14h



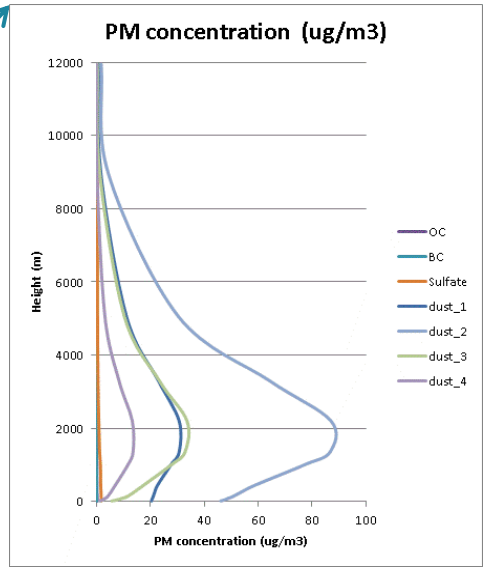
- ✓ higher concentrations in the South
- ✓ Clear influence of mineral dust

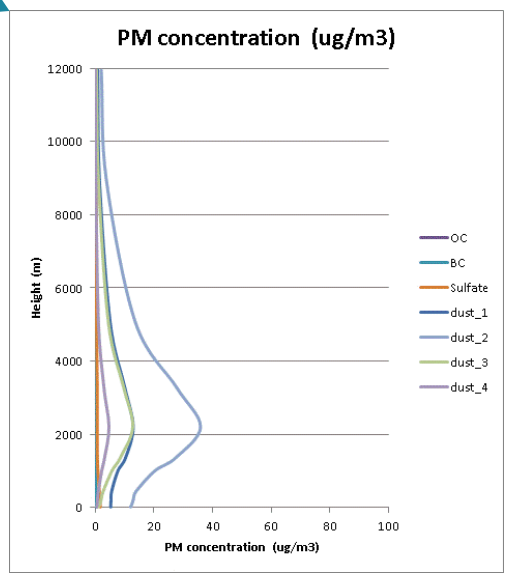
Results and discussions

CAMx results - Vertical profile of PM concentrations



- ✓ Highest concentrations at 2000 m
- ✓ South of domain presents higher concentrations in all layers
- ✓ Major contributions of dust bin 2 (1.0µm-2.5µm)

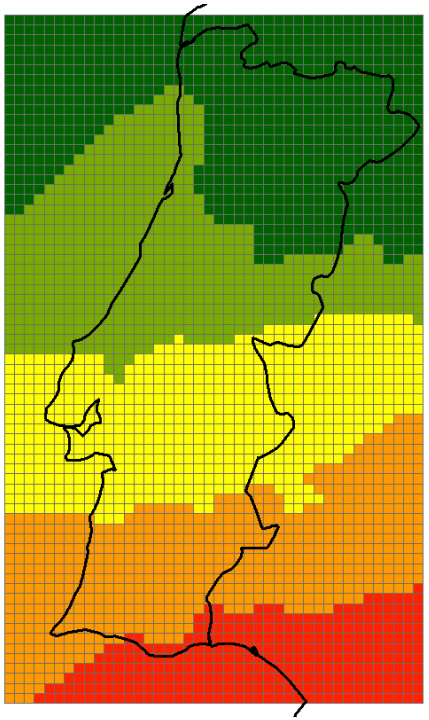




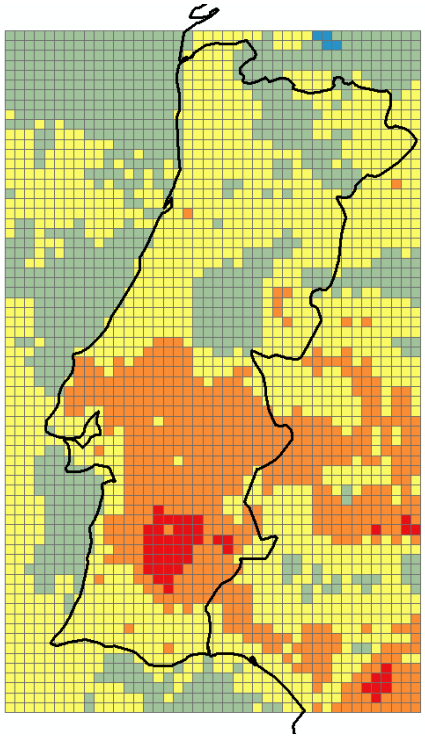
Results and discussion

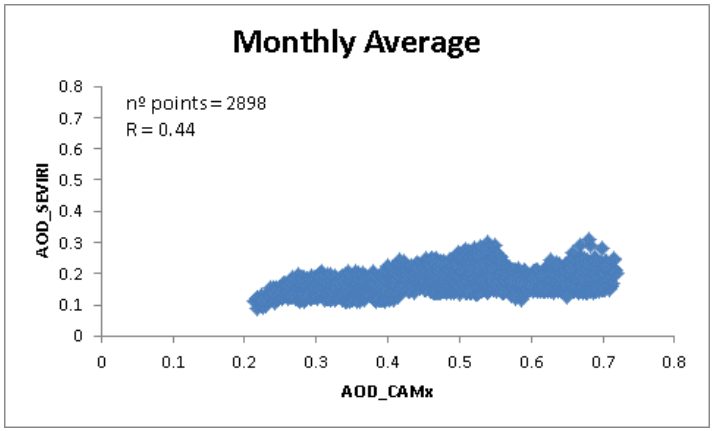
Monthly Average

AOD CAMx



AOD SEVIRI





AOD CAMx

- 0.10- 0.30
- 0.30 - 0.40
- 0.40 - 0.50
- 0.50 - 0.60
- 0.60 - 0.75

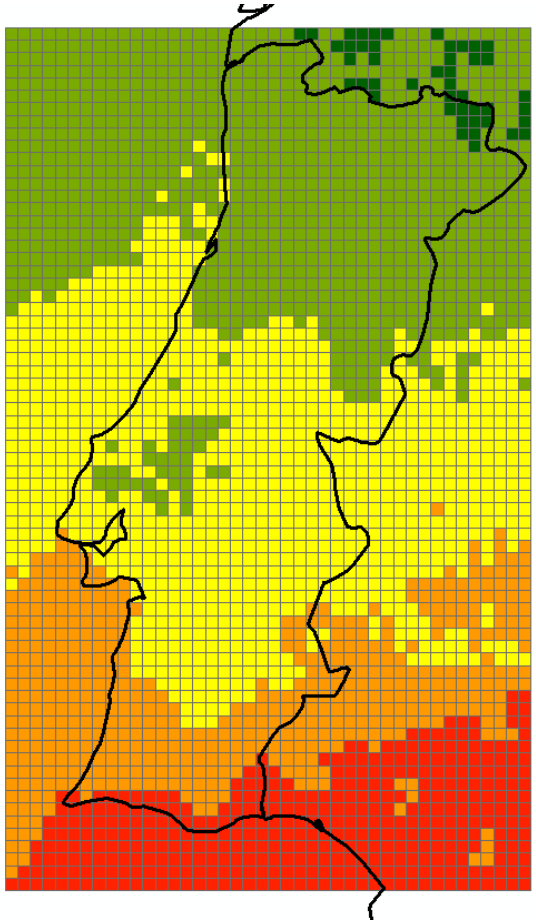
AOD SEVIRI

- 0.00 - 0.10
- 0.10 - 0.15
- 0.15 - 0.20
- 0.20 - 0.25
- 0.25 - 0.35

✓ The correlation value is 0.44 between CAMx and SEVIRI for monthly average data.

Results and discussion

Difference between CAMx and SEVIRI using monthly average data

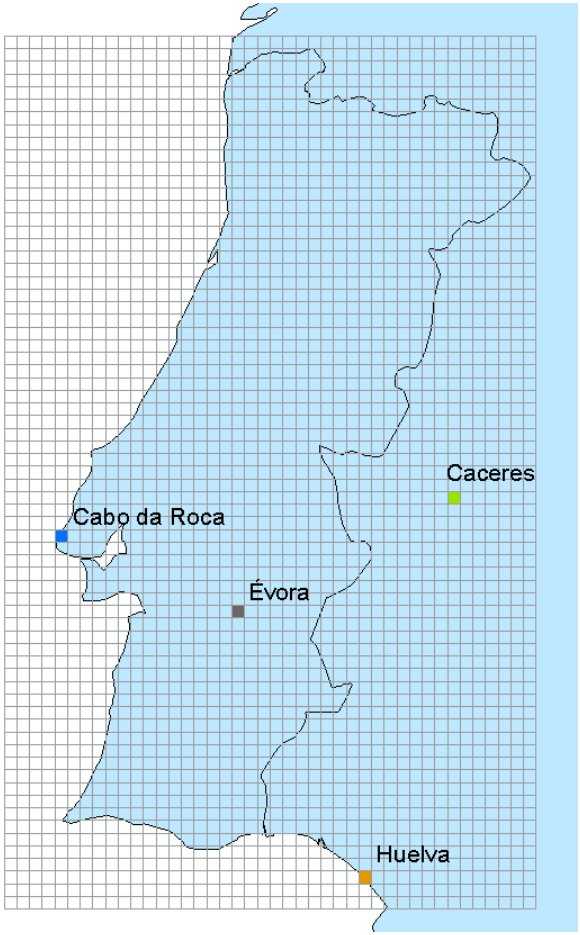


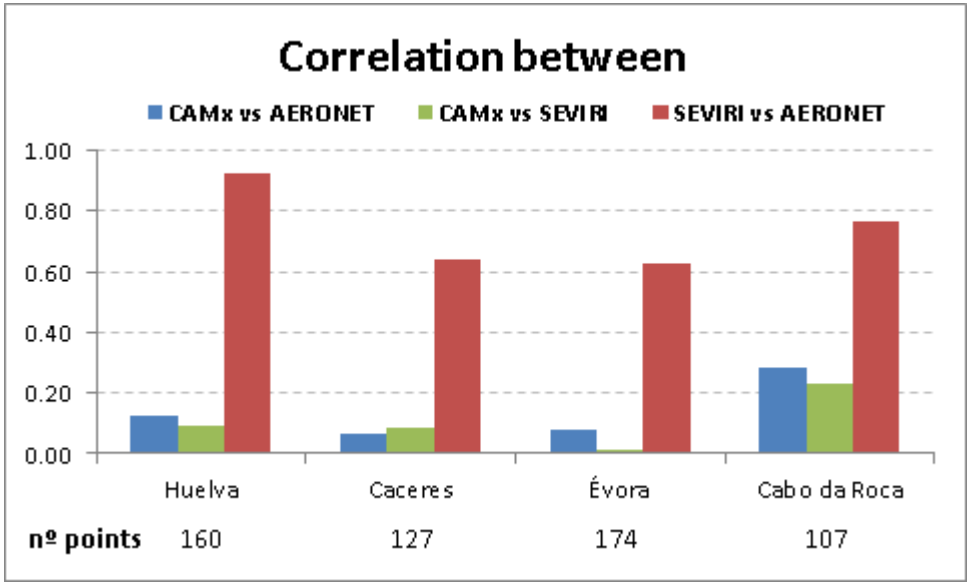
- ✓ The difference on South of the domain the is about 0.30 to 0.60
- ✓ CAMx overestimation in all points of the domain

Overestimation of AOD due to overestimation of inert particles as boundary conditions from EU domain as a consequence of global model

Results and discussion

Validation of hourly data



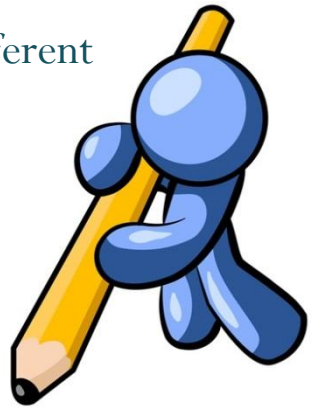


Disagreement between AERONET data and CAMx results

Good agreement between AERONET data and satellite observations

Conclusions

- The correlation between CAMx and SEVIRI for monthly average data is 0.44
- Overestimation of AOD due to overestimation of inert particles as boundary conditions from EU domain as a consequence of global model
- Good agreement between AERONET data and satellite observations
- Disagreement between AERONET data and CAMx results
- Next step is to improve the Boundary Condition used in CAMx to achieve better results
- This work provides relevant background to start the integration of these two different types of the data in order to improve air pollution assessment



Thanks for your attention!

Acknowledgements:
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